

DIFFERENCES IN SOME ANTHROPOMETRIC PARAMETERS BETWEEN BASKETBALL, HANDBALL AND VOLLEYBALL ELITE ATHLETES IN KOSOVO

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Abstract: *The anthropometry, composition and the body structure of the elite players of ball sports played by hand, were different based on the type of sport, selection criteria, hours of practice and the specific physiological demands during the game can explain the noticed differences. Surely, much more data is required to define the anthropometric profiles of international female athletes in the sports of basketball, volleyball and handball (Bayios, et al., 2006). Summary of this study: The results showed the anthropometric measures of the professional players of the main three sports differ from one another while in the meantime there was no significant differences between the sports in the measures of the biceps and suprailliac skinfold. Based on this study, sports have specific demands of anthropometric attributes which are specific for each player of the three sports: basketball, volleyball and handball. Therefore, due to the diversity of the results, coaches have to create training programmes based on the sports specific demands and all the athletes in the field.*

Key words: *body composition, weight, body height, BMI, perimeter.*

1. Introduction

Ball sports require full involvement, physical, technical, mental and tactical abilities. In between them, physical attributes of the athlete create significant effects in the skills of the athletes themselves and also the team tactics and performance. Considering that, the athletes need to have physical abilities in order to meet the demands of the sports. In today's age, sport has become a cultural

attraction in big and compels scale. Its aim is impressive and almost everyone around the world engages with some sportive activity in one way or another. Sport has spread massively around the globe.

Different research studies carried by experts of physical education and sports have emphasized the high importance of specific structures conjoined with different sportive activities for the selection and the development of talents in sports for the best appearance in

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different levels of sportive competitions. There are a number of factors that determine the results of the athletes.

For example in a study [14] it is concluded that there are some anthropological and body composition differences that can significantly improve one's performance and allow transition to the highest level. With these results, the authors would like to facilitate the player selection process, especially when transitioning from elite youth programs to the professional level

Additionally significant factors are, physical, mental, technical and tactical. Between them, the anthropometric parameters and physical characteristics are of the biggest importance. The results depend on skills, training, motivation and other physiological factors. In Kosovo, continuously attempts were made to improve the standards of the athletes for and there has been achieved some visible success until in this area. Successful results in the international sports competitions require a valuation of physical requirements of the athlete itself and the capacity of the team to meet those requests. Optimal appearance nowadays requires a perfect combination of technical and tactical skills and also a high level of physical parameters. More favorable and sustainable results can be achieved by athletes that are better physically prepared in order to discover the importance of tests in the educational sports programmers. Nonetheless, the obvious decrease of effectiveness should be in the centre of attention of coaches.

In a recent study [6] it was found that muscle content of professional handball and basketball players were significantly higher than their control subjects, while bone content of basketball players were

insignificantly higher than handball players and significantly higher than control subjects.

Concerns over the evaluation of physical preparedness and the decrease of effectiveness of basketball players initiated the study of [4] to carry the anthropometric tests and athletic-physical tests based on the age and year of recruitment. According to the above study some results of athletic-physic preparedness deteriorated in the course of an 8 year period. In addition, there was a slight increase in of the sprint times and decrease of effectiveness in the round-and-back (medium in the Male National Team and obvious in the female National team).

2. Methods

Forty-one (N= 41) professional elite male athletes (14 basketball players, 12 handball players, 15 volleyball players) have voluntarily participated in this study. For each athlete anthropometric measures such as: weight, body height, supralillac, waist perimeter and BMI measures in each sport were carried. In addition, three additional perimeter measures were taken (Shoulders, thighs and pulp) and measures of fat skin folds (biceps, triceps, supralillac, sub scapular) of the athletes participating in this study.

The athletes appeared on the court at 8:00 am. The measures were taken for each athlete for Body Height (cm), body weight (kg) and waist perimeter. The body mass measures were carried using a SECA 217 gradual stadiometer with 1mm graduation, while the body weight was determined by electronic scale with accuracy up to 0.1kg.

BMI was calculated using the usual formula taken from the measures of weight and body height.

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS version 17.0). Analysis of variance (ANOVA) was carried into the tests in order to identify the differences for each sport. Having considerable differences in the average, it was proceeded with post hoc Tukey test which is used to determine comparison in analysis for each athlete, which in the end determined the important differences. Significant level of $p \leq 0.05$ was accepted.

Sample of variables

Three indicators were measured for each athlete: height, body weight, body mass index (BMI) and waists perimeter. Also measures for unique characteristics were selected because we believe that they affect in motoric ability and help in the athletes' performance.

Perimeter of: shoulder, thigh and pulp. Skin fold measurements of biceps, triceps, supralillac and sup scapular.

3. Results

The comparison of height (table 1) between basketball and handball athletes is $p=0.000$ (Avg diff = 16.66; Std Error = 2.77), between basketball and volleyball is $p=0.000$ (Avg diff = 11.75; Std. Error = 2.63), between handball and volleyball $p=0.070$ (Avg diff = -4.92; std error = 2.63). Basketball players were also considerably higher than volleyball players (+11.8 cm; $p \leq 0.05$) and handball players (+16.6 cm; $p \leq 0.05$) while volleyball vs. handball (+4.9 cm; $p > 0.05$).

Comparison of weight between basketball and handball is $p=0.000$ (Avg diff. = 23.72; Std. error =3.54), basketball and volleyball $p=0.000$ (Avg diff = 20.07; std error 3.40) and between handball and volleyball $p=0.309$ (Avg diff.=3.65; std error=3.54). In addition to the above, basketball players were considerably heavier than volleyball players (+20 kg; $p \leq 0.05$) and of handball (+23.7 kg; $p \leq 0.05$) while the volleyball and handball (+3.6 kg; $p > 0.05$).

BMI comparison between basketball and handball is $p=0.003$ (Avg diff=2.62; std error=0.82), between basketball and volleyball $p=0.002$ (Avg diff =2.59; std error =0.79) while between handball and volleyball $p=0.0967$ (Avg diff = -0.35; std Error = 0.83). BMI of the basketball players was higher than volleyball (+2.6 kg/m²; $p \leq 0.05$) and handball players (+2.6 kg/m²; $p \leq 0.05$), while volleyball players vs. handball players (+0.03 kg/m²; $p > 0.05$) while the waist perimeter was higher than that of volleyball players (+7.3 cm; $p \leq 0.05$) and handball players (+7.6 cm; $p \leq 0.05$) differences between volleyball and handball (+0.3 cm; $p > 0.05$).

Comparison between waist perimeter between basketball and handball $p= 0.002$ (Avg diff= 7.57; Std error= 2.22), basketball and volleyball $p= 0.002$ (Avg diff= 7.3; Std error= 2.14), handball and volleyball $p= 0.889$ (Avg diff= -2.74; Std error= 2.14).

Table 1

Deep comparison data between the measures of height, weight, BMI and waist perimeter for the sports of basketball, handball and volleyball are given

| ANOVA | | | | | | |
|-----------------|----------------|-------------------|-----------|--------------------|---------------|-------------|
| | | Amount of squares | df | Average of squares | F | Sig. |
| Height | Between groups | 1774.423 | 2 | 887.212 | 19.235 | .000 |
| | Inside groups | 1660.500 | 36 | 46.125 | | |
| | Total | 3434.923 | 38 | | | |
| Weight | Between groups | 4393.072 | 2 | 2196.536 | 27.115 | .000 |
| | Inside groups | 2997.322 | 37 | 81.009 | | |
| | Total | 7390.394 | 39 | | | |
| BMI | Between groups | 61.771 | 2 | 30.885 | 6.948 | .003 |
| | Inside groups | 164.475 | 37 | 4.445 | | |
| | Total | 226.246 | 39 | | | |
| Waist perimeter | Between groups | 453.449 | 2 | 226.724 | 7.644 | .002 |
| | Inside groups | 1038.065 | 35 | 29.659 | | |
| | Total | 1491.514 | 37 | | | |

In Table 2 are given the comparison data between the measurements of the perimeter of shoulder, thighs and pulps between the sports of (basketball, handball and volleyball). The comparison of the shoulder perimeter is $p=0.000$ ($F=16.263$), thigh $p=0.045$ ($F=3.376$), IMT $p=0.003$ ($F=6.948$), and pulp $p=0.002$ ($F=7.657$). Shoulder perimeter – basketball players have higher values than volleyball (+4.7 ; $p \leq 0.05$) and handball (+5.4; $p \leq 0.05$), while volleyball player vs. handball players (+0.6 ; $p > 0.05$).

Thigh perimeter- basketball players have higher values than volleyball players (+6 ; $p \leq 0.05$) and handball (+5.8; $p \leq 0.05$), while volleyball Players vs. handball players (-0.1 ; $p > 0.05$). Pulp perimeter – Basketball players have higher values than that of volleyball players (+3.1; $p \leq 0.05$) while handball Players (+2.8; $p \leq 0.05$), while volleyball players vs. handball players (-0.4 ; $p > 0.05$).

Table 2

Comparison of measurements of the perimeter of shoulder, thigh and the pulp between the sports of basketball, handball and volleyball

| ANOVA | | | | | | |
|--------------------|----------------|-------------------|-----------|--------------------|---------------|-------------|
| | | Amount of squares | df | Average of squares | F | Sig. |
| Shoulder perimeter | Between groups | 239.980 | 2 | 119.990 | 16.263 | .000 |
| | Inside groups | 280.361 | 38 | 7.378 | | |
| | Total | 520.341 | 40 | | | |
| Thigh perimeter | Between Groups | 323.024 | 2 | 161.512 | 3.376 | .045 |
| | Inside groups | 1817.832 | 38 | 47.838 | | |
| | Total | 2140.856 | 40 | | | |
| Pulp perimeter | Between groups | 82.143 | 2 | 41.071 | 7.657 | .002 |
| | Inside groups | 203.838 | 38 | 5.364 | | |
| | Total | 285.980 | 40 | | | |

In table 3 given are the data for comparison between the measurements of skinfold between the three disciplines of sports, basketball, handball and volleyball.

Comparison for biceps (skinfold) it's $p = 0.086$ ($F = 2.621$), triceps (skinfold) it's $p = 0.015$ ($F = 4.737$), suprailliac (skinfold) it's $p = 0.130$ ($F = 2.156$), subscapular (skinfold) it's $p = 0.002$ ($F = 7.419$).

While in the triceps skin fold measurements: basketball players had higher values than volleyball (+2.2 mm; $p \leq 0.05$) and handball (+3.6 mm; $p \leq 0.05$), while volleyball and handball players (1.3mm; $p > 0.05$) and the sub scapular skin fold: basketball players have higher values than volleyball (+2.9 mm; $p \leq 0.05$) and handball (+2.8 mm; $p \leq 0.05$) while volleyball and handball (-0.1mm; $p > 0.05$).

Table 3
Comparison between the measurements of skinfold between the three disciplines of sports, basketball, handball and volleyball

| ANOVA | | | | | | |
|------------------------|----------------|-------------------|-----------|--------------------|--------------|-------------|
| | | Amount of squares | df | Average of squares | F | Sig. |
| Biceps (skinfold) | Between groups | 8.932 | 2 | 4.466 | 2.621 | .086 |
| | Inside groups | 64.738 | 38 | 1.704 | | |
| | Total | 73.670 | 40 | | | |
| Triceps (skinfold) | Between groups | 87.109 | 2 | 43.555 | 4.737 | .015 |
| | Inside groups | 349.370 | 38 | 9.194 | | |
| | Total | 436.480 | 40 | | | |
| Suprailliac (skinfold) | Between groups | 45.997 | 2 | 22.999 | 2.156 | .130 |
| | Inside groups | 405.335 | 38 | 10.667 | | |
| | Total | 451.332 | 40 | | | |
| Subscapular (skinfold) | Between groups | 74.097 | 2 | 37.049 | 7.419 | .002 |
| | Inside groups | 189.762 | 38 | 4.994 | | |
| | Total | 263.860 | 40 | | | |

4. Discussion

The aim of this study is the comparison of anthropometric measurements of professional elite athletes in three different sports, that of basketball, handball and volleyball. From this study we can conclude that the measurements of weight, height, BMI, waist perimeter and the perimeters of the three main

muscular areas of basketball players were considerably higher (significant $p \leq 0.05$) than that of athletes of volleyball and that there is no significant differences in the measurement of skin fold of biceps and suprailliac. According to [1] the anthropometry, composition and body structure of elite players in hand sports differ based on type of sports. Anthropometric characteristics can affect

the procedures for the selection of young basketball players but nonetheless the determiners of success are a bunch of factors, [5]. Results of the discriminatory analysis [13] show that anthropometric status makes the difference between the basketball players based on game positions. Surely, more data is required to determine the anthropometric profiles of international female athletes for basketball, handball and volleyball [1]. Successful appearances require explosive force of legs and shoulders, speed in sprint and kinesthetic feelings in ball control (Sibila, M., 1997). In the other hand, for a role model player of handball player, have to be considered important the stature length, spread shoulders, hand extension (Sibila, M., 1997); [11]. Such a anthropometric profile plays a supporting role in helping the players to compete in the current conditions [11].

Physical characteristics of a player are important factors in determining if he/she will achieve a high level in the specific sport that he or she chose (Sallet et al., 2005). According to [9] it has been demonstrated that relative isokinetic indicators of professional basketball players were similar with those of young basketball players. Height and body mass of basketball players is one of the factors that determine and evaluate their position in the game [4]. In this study, guards were considerably shorter than forwards and centers ($p \leq 0.05$). This conclusion was reached in many more studies ([3]; [7] Sallet et al, 2005).

The main results of the present study indicate that the anthropometric and physiological profiles of basketball, handball and volleyball players are significantly different. Basketball players are taller than handball players. Volleyball

and basketball players show higher standing reach values than handball players, whereas the latter have the higher body fat percentages among the three sports. Although significant differences were not found, handball is the discipline where players have the highest body weight and body fat percentages, presenting a height and standing reach values closer to volleyball than to basketball players [8].

5. Conclusions

The results here have shown that anthropometric measures of the professional athletes of the three main hand sports have differences between them, in the meantime no significant differences were identified between sports in the measures of the skin fold of biceps and supralillac. Based on this study, sports have specific demands of anthropometric attributes which are specific for each player of the three sports: Basketball, volleyball and handball.

According to [14] body fat, skinfold measurement, body height and diameters were found to be key components in the makeup of an elite player and often these were indicators of the level of play and the leagues that each player competed in. Playing positions were determined by anthropological measurements in body mass, height, and body perimeters and were also a significant indicator of the level of play.

Therefore, due to the diversity of the results, coaches have to create training programmes based on the sports specific demands and each of the athletes in the field.

Specific anthropometric characteristics differ mainly at the professional male

basketball players. These results suggest that common physical and anthropometric characteristics have to be considered in every selection test of the different sports. However, selection should not be solely limited to anthropometric data especially in the young generations where maturity has to be considered. Full measurement of physical characteristics in combination with other specific game tests of the specific sport in all three of them (aiming precision, passing ability, slalom dribbles) have to be also included in the selection procedure.

The ability to move with the ball, the ability to change the speed in turns, ability to aim the accuracy to score, the ability to move in a triangle scheme (defense move) are very important parameters and have to be considered carefully when the players are tested.

The evolution of standard test that simulate real game situations together with the evaluation of unique skills of physical preparation and anthropometric characteristics are decision making for the future of one team.

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